Weather InformatioN Network (WINN)

Weather Accident Prevention Annual Project Review

May 23, 2000

Dan Leger

Honeywell

Aviation Information Services Solutions

Passenger

- Information services
  - weather, stock, news
  - aircraft position map
- Communication services
  - voice, fax
  - TV, video conference
  - e-mail, internet
- Emergency medical support

Enroute

Crew

- Trip re-plan/diversion
  - new ground arrangements
  - new flight plan
- Weather uplink
- Operational communications

Hangar

- Scheduled maintenance
- Unscheduled maintenance
- Flight info. services
- Internet based training
- Crew medical training

Operations

- Aircraft and crew scheduling
- Trip planning
  - aircraft arrangements
  - crew and passenger arrangements
- Medical alerts

Departure

Arrival

Passenger

- Passenger care
- Medical coordination

Crew

- Next trip planning
- Electronic-Log book update
- Remote comm.

Aircraft

- Unscheduled maintenance
- Fuel arrangements
- Aircraft security

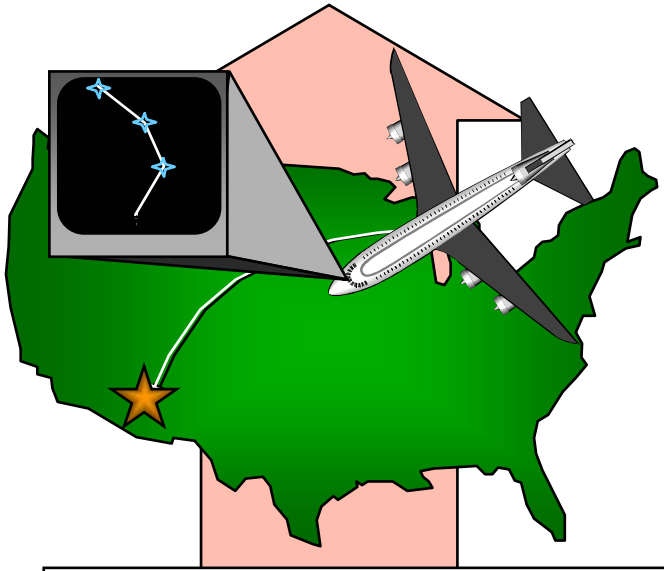
Pre-flight

In-flight

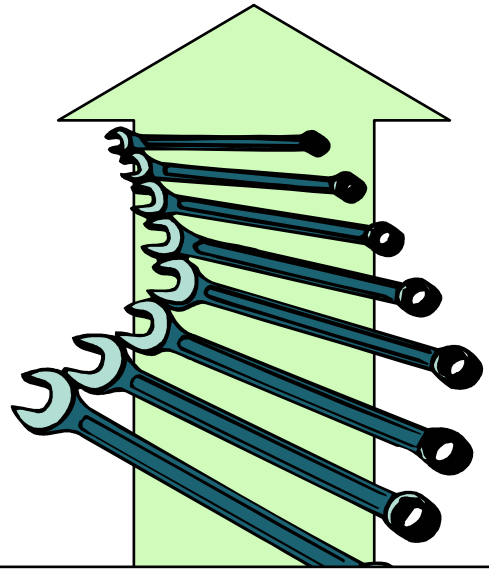
Post-flight

Aviation Information Services Strategy

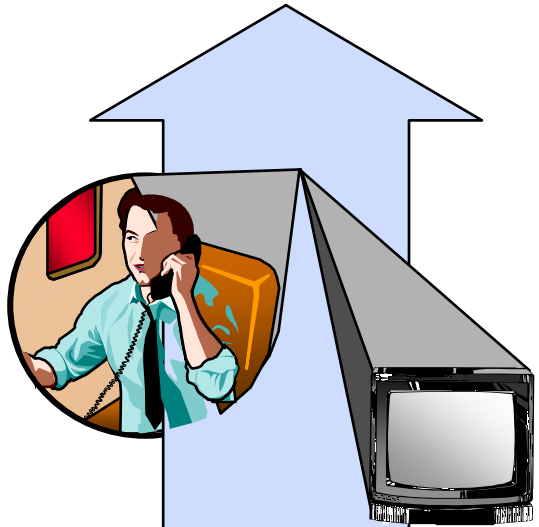
Flight Operations



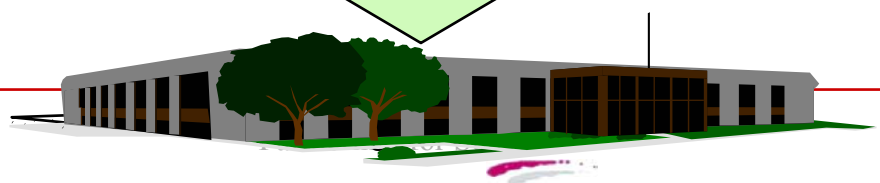
Maintenance



Cabin



Provide integrated end-to-e communications and information based solutions for full mission support



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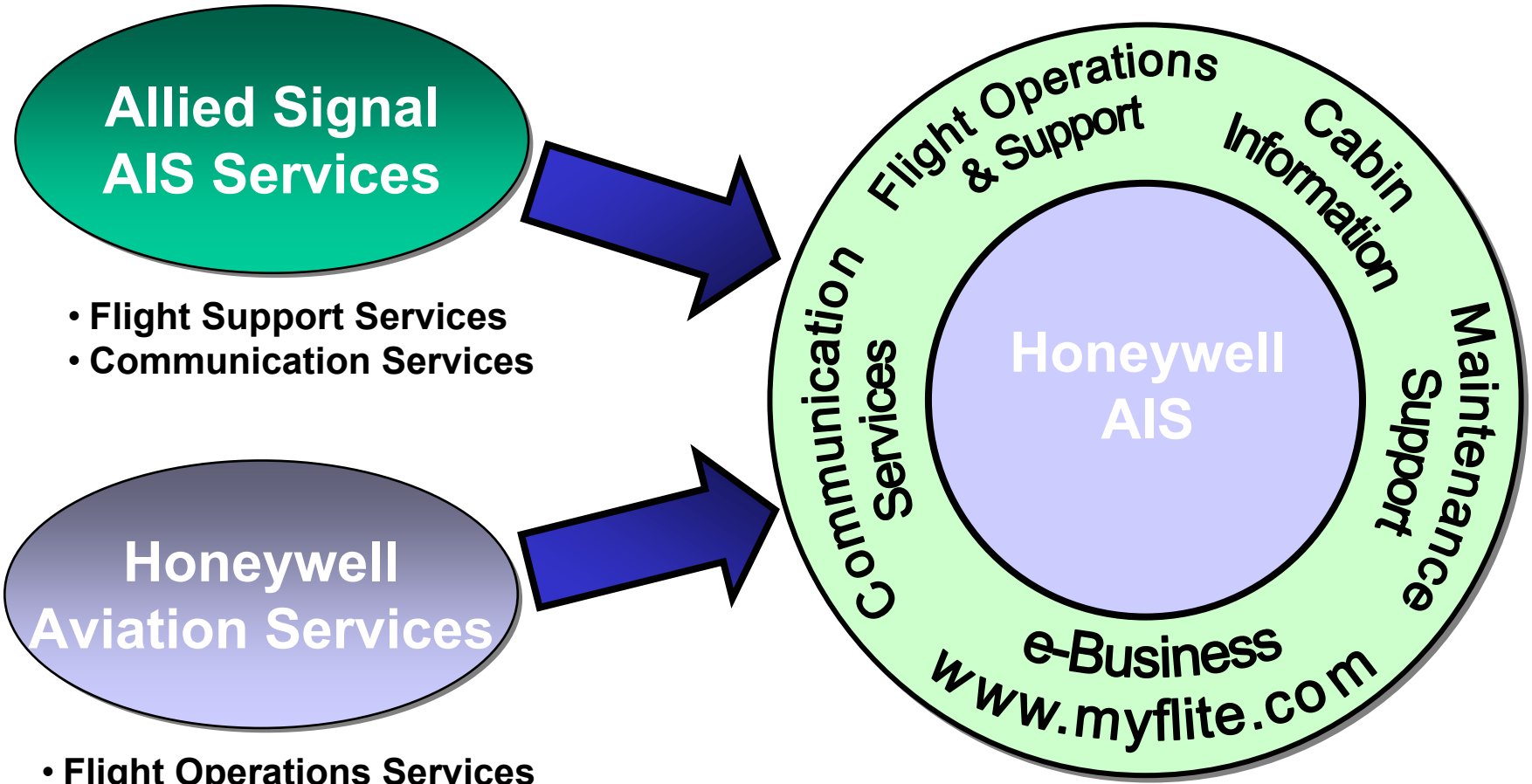
The New Aviation Information Services



Compliment Fit for Growth

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One View™ - Direct Broadcast System

What services do airborne DBS systems provide?

- Live broadcast of news, sports, weather and entertainment to aircraft via satellite television.
- Thousands of tracks of high quality digital music.
- Serve as platform for bringing high speed computer data for internet browsing and e-mail to the aircraft.

Why install a DBS system on your aircraft?

- Stay informed about global news, the stock market and the weather.
- Provide favorite sports and television shows aboard your aircraft.
- Position for high speed data capability.

Honeywell One View™

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AMOSS

Aircraft Maintenance & Operations Support System (AMOSS) **provides a total maintenance and flight operations solution - current focus is Line maintenance.**

This is accomplished through:

- **Model Based Diagnostics Successfully Applied in the B-777 CMC**
- **Workflow Management**
- **Electronic Document Integration**
- **Legacy System Interfacing**
- **ACARS Message Processing**
- **Integrating Airborne Systems with Ground Systems**
- **Tailorable User Interface**

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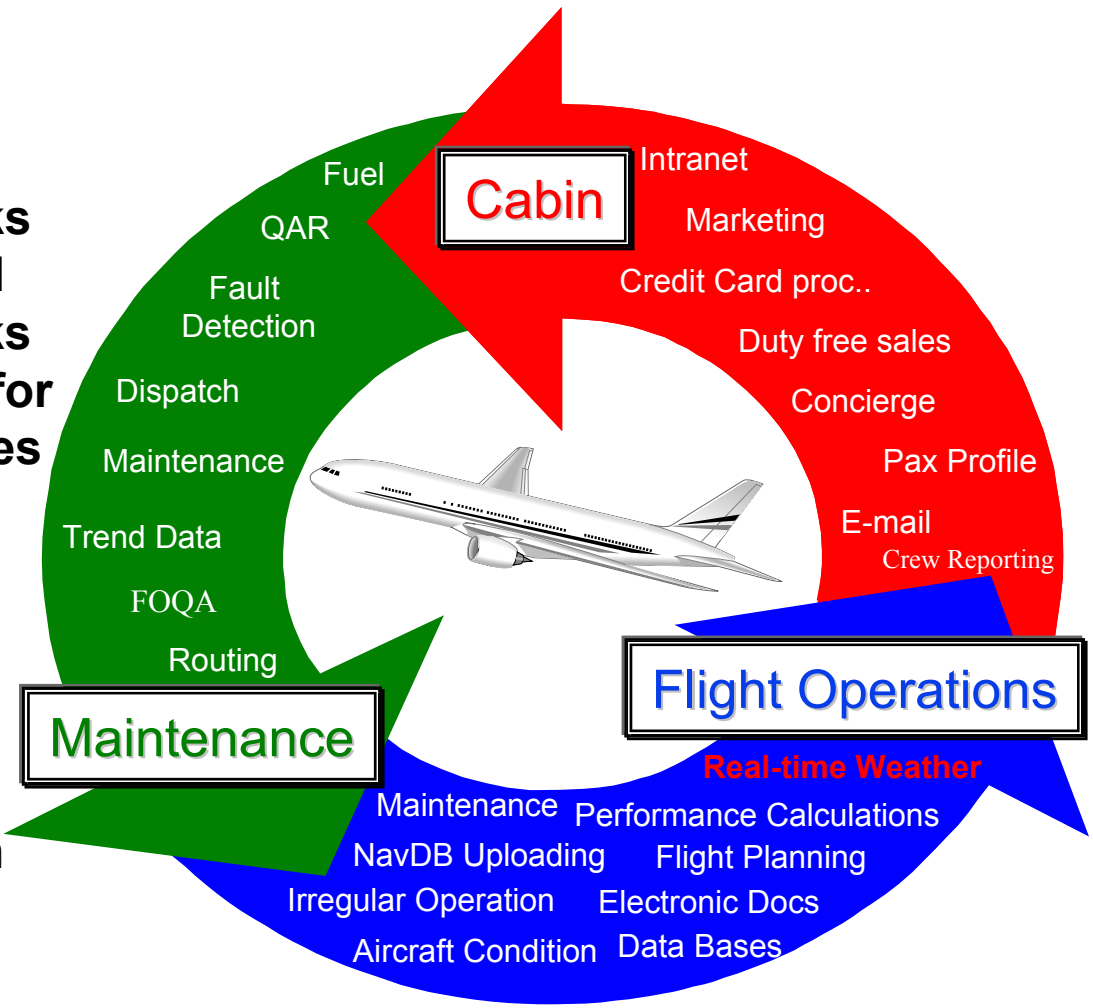
Total Aircraft Information System (TAIS)

What is the Honeywell Total Aircraft Information System (TAIS)?

- **Networks the aircraft**
- **Establishes communication links between the aircraft and ground based communications networks**
- **Provides valuable applications for Flight Operations, Cabin Services and Maintenance**

What benefits does TAIS provide?

- **Generate Revenue**
- **Reduce Maintenance Costs**
- **Increase Customer Satisfaction**
- **Increase Crew Efficiencies**
- **Increase Safety**



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TAIS Background

Total Aircraft Information System (TAIS) background:

- **Based on Commercial Off the Shelf (COTS) components and software**
- **Open system architecture design**
- **System architecture supports interfaces with classic avionics as well as In-Flight Entertainment (IFE), crew and passenger services**
- **Honeywell provides system integration**
- **Designed to DO178B, DO160D**
- **Evolving technology and products**

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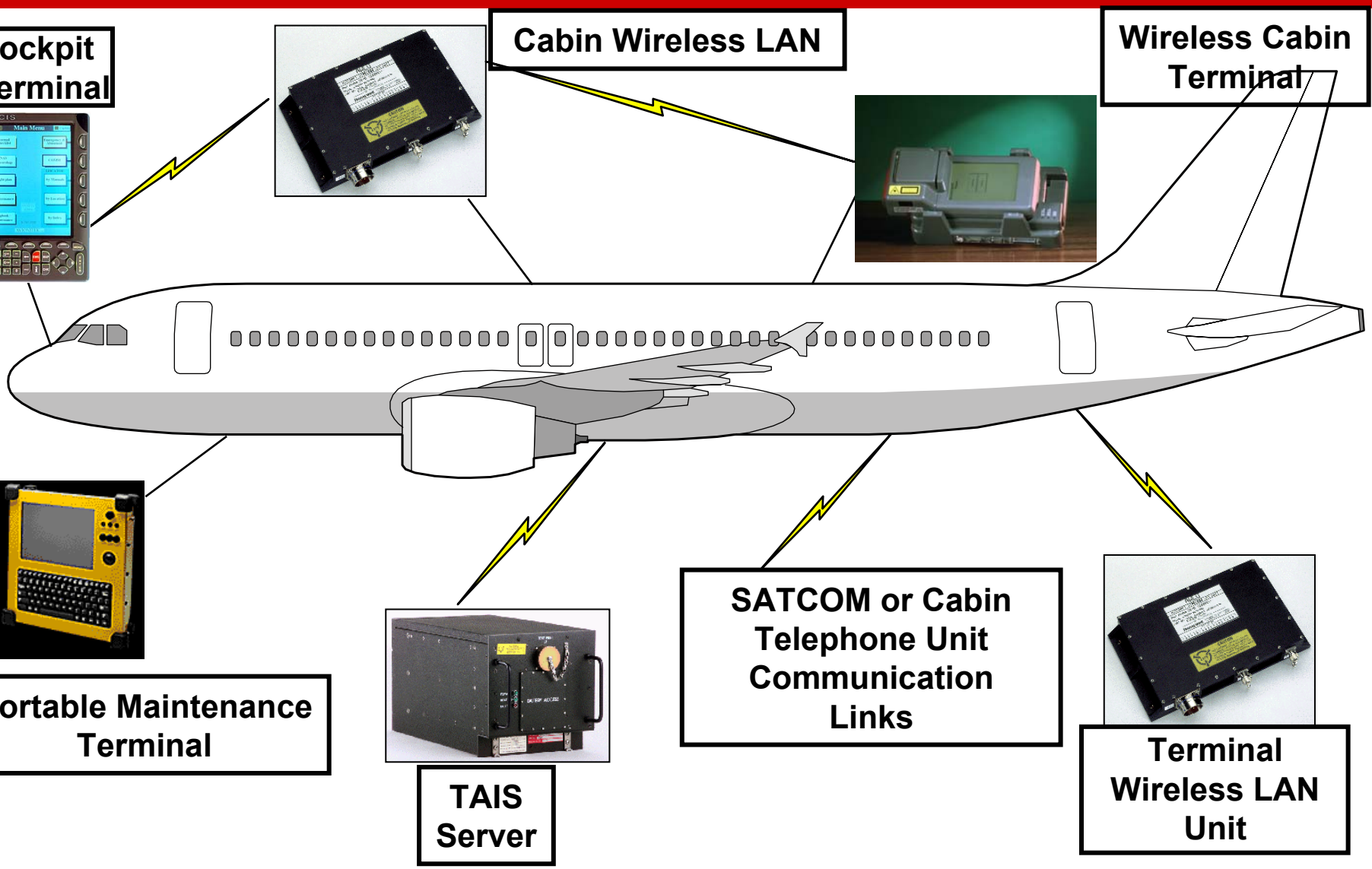
Total Aircraft Information System Architecture



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Aviation Information Services Data Center

HI Data Center Services:

- **Internet Service Provider**
  - Airborne E-Mail and Intranet (Content Updates)
- **FMS Navigation Data Base (NDB)**
  - NDB electronic delivery to the airline
- **Electronic Commerce**
  - Credit card validation and billing
- **Weather Information Network (WINN)**
  - Graphical and textual weather information
- **Voice Services**
  - OneLink™ automated calling system

Phoenix

Honeywell

Accomplishments to Date

Accomplishments to date

- **Established Automated Data Center(7x24 operation)**
  - Data provider connectivity
  - Algorithm creation
  - Archiving incoming and outgoing files
- **Investigated and/or successfully tested multiple communication solutions**
  - **Data 3 over Satcom**
  - **Circuit mode over UHF**
  - **ACARS**
  - **DBS data link**
  - **Others**
- **Packaging optimization**
  - **Extensive review of data compression alternatives**
  - **Sending only gridded data; no basemap**
    - **Greater user display flexibility**

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Accomplishments to date

- **Successfully integrated all components and conducted both systems and operational human factors evaluations in Honeywell simulator 777 and MD-10**
  - **Systems**
    - **End-to-end installed, including**
      - Communications
      - Aircraft LRUs
  - **Evaluators**
    - **United Air Lines**
    - **Delta Air Lines**
    - **NASA**

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Accomplishments to date

- **Installation and successful series of flight tests in Corporate Citation III**
  - **First Flight July 16, 1999**
  - **Conducted 36 test flights**
  - **Demonstrated system to Delta, UAL, Swissair and NASA**

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Accomplishments to date

AIR TRANSPORT

WINN Gives Flight Crews Graphical Weather Picture

WILLIAM B. SCOTT/DENVER

Next summer, NASA will fly a new graphical aviation weather distribution and display system on its Boeing 757 testbed to evaluate how the system can help pilots avoid turbulence and other potentially hazardous atmospheric conditions.

Developed by a Honeywell-led team under a 1998 NASA contract, this Weather Information Network (WINN) will give pilots a "big-picture" view of weather systems while airborne, enabling them to make better rerouting decisions. Today, crews can receive verbal and data link text messages with weather updates to augment what they see on their in-cockpit weather radar displays, but have to mentally combine various data to understand the larger situation. WINN does much of that work for the crew, presenting a graphical composite of radar, satellite imagery, convective weather, icing and clear air turbulence (CAT) information.

"The advantage of [WINN's] weather products is they help pilots make better decisions," said W. Michael Fisher, a United Airlines Boeing 727 captain who evaluated WINN and other weather information systems under NASA's Aviation Safety Program. "With WINN, you can anticipate where that weather is going to be and see it in graphic terms. You don't have to read through pages and pages of text. You can quickly see what the threats are and make a better decision [that enables] flying a more efficient route from point 'A' to point 'B.' With on-board weather radar, I'm looking at a side view of the weather in front of me, not from the top down. With these new products, I can see the best way to go in order to avoid that weather."

An earlier NASA research program called Cockpit Weather Information or CWIN demonstrated that color-coded composite weather information—regularly transmitted from ground sites and presented as graphical displays on the flight deck—allowed flight crews to fly more efficient routes. They flew "shorter en route segments, used less fuel and cleared thunderstorm cells by greater distances when using the CWIN system," according to a NASA Langley Research Center report.

An Avionitek display mounted in a United Airlines simulator depicts a graphical weather presentation compiled by Honeywell's data center and transmitted to airborne transports.

WINN is one of several weather information development efforts under NASA sponsorship. All are attempting to use software, multiple data sources and data links to deliver better weather and other information into the cockpit. "We're trying to give pilots at least the same level of information—while they're in the air—that you can get at home on the Weather Channel," a Honeywell official said.

Because delivering a comprehensive weather picture to the flight deck involves several disciplines, no single entity had developed a complete solution. NASA's program attempts to combine expertise in meteorology, communications, information management, human factors, logistics and system integration to provide crews information they need, when they need it.

The Honeywell team, for example, includes ARINC, Weather Services International (WSI), National Center for Atmospheric Research (NCAR), United Airlines, Comsat, Kavouras, National Weather Service's Aviation Weather Center, and SITA, an international air-to-ground data communications organization that uses both VHF radio and satellite links. WINN was built on work completed by NASA's earlier CWIN program, with special emphasis devoted to system integration and computer/human interface issues.

Aviation weather data from the National Weather Service, WSI, NCAR and Kavouras are fed to a special Honeywell data center via broadcast satellite and ground links. The center processes and compresses those data before transmitting graphical weather information to aircraft at regular intervals. On the flight deck, the information is stored on a network computer or "server," which feeds two "clients"—Avionitek flat-panel displays positioned near each pilot.

For airline evaluations and a recent demonstration for aerospace reporters, one Avionitek display was mounted on the right side of a United Boeing 777 simulator at the carrier's flight training center here. Pilots could view a variety of weather presentations and make early decisions to avoid those systems. WINN allows longer-term strategic planning, augmenting on-board weather radar, which is used as a tactical, short-term decision aid.

"I find that I can maximize my rerouting opportunities and minimize fuel use [through] good strategic rerouting, rather than driving up to the weather, then having to zigzag through it," said Ron Diedrichs, an airline captain and manager of flight operations programs for Honeywell Commercial Aviation Systems. When

66 AVIATION WEEK & SPACE TECHNOLOGY/FEBRUARY 21, 2000

- **Installed and evaluated in UAL 777 simulator**
  - **Held 8 days worth of evaluations (2 evals per day)**
  - **Conducted both airline and media day**
  - **Released final report**

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Goals for 2000

- Complete UAL Full Flight Simulator evaluation
- Integrate other Honeywell and former Allied Signal programs
  - AWIN
  - Route Optimization
  - Wxsight
  - Airborne sensors
- Conduct an In-Service Evaluation with UAL using new architecture
- Conduct evaluation on NASA 757
- Finalize communications roadmap
  - What solutions when
  - Technical and financial
  - Looking at a variety of potential solutions

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Weather Information Network (WINN)

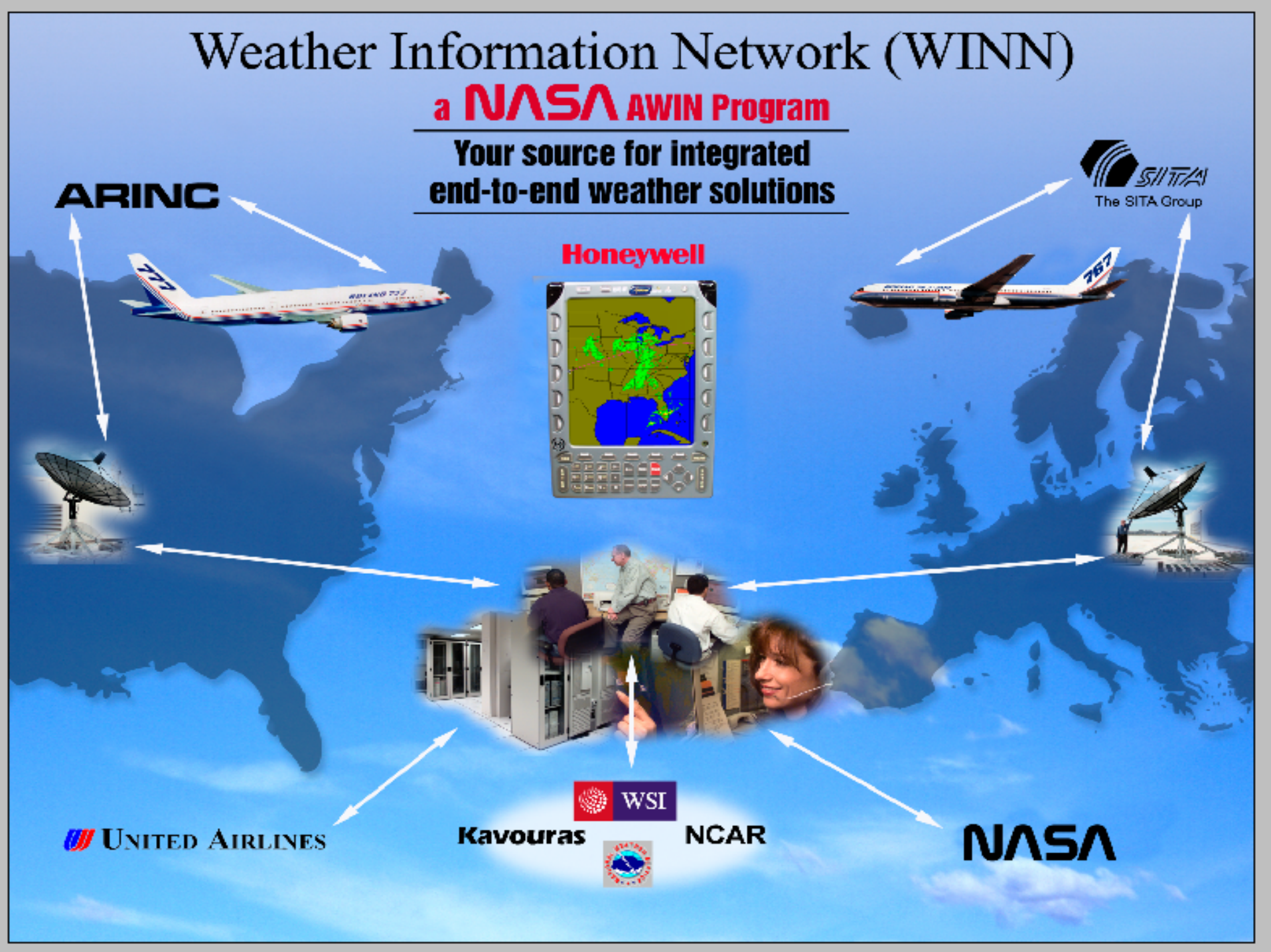
a NASA AWIN Program

Your source for integrated end-to-end weather solutions

ARINC

SITA
The SITA Group

Honeywell



WSI

Kavouras

NCAR

UNITED AIRLINES

NASA